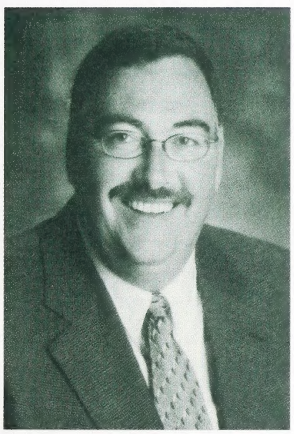
# GREEN MATTERS

A newsletter from the Alberta Environmentally Sustainable Agriculture Council



Roth & Ramberg Photography

## From AESA Council's Chair

*by John Kolk, Poultry Industry Council*

# Making the Most of the Energy Challenge

The need to use our energy resources more efficiently has been brought home on our farm operation. The annual natural gas charges and delivery charges on our chicken operation have jumped nearly 300% in the past five years. Our electrical charges and delivery charges for irrigation, ventilation and lighting have also doubled.

My first response has been to complain about deregulation and try to lock in prices. My second response has had to be conservation and alternative energy production.

This issue of Green Matters deals with the use of energy on the farm and in processing plants. It builds on some of the concepts and concerns discussed in the Green Matters issues of Winter 2000, Fall 2000 and Spring 2001, and in the Alberta Environmentally Sustainable Agriculture (AESA) Council's workshop on alternative energy production held in March 2002. Energy management keeps surfacing again and again as a key component in the sustainability of our agriculture and food processing sectors.

The challenges around energy aren't going away. We continue to have rising energy costs coupled with market pressures to put a lid on the prices for the products we produce using that energy. We continue to see pressures to reduce greenhouse gas emissions related to the Kyoto Protocol (the international agreement on greenhouse gas emissions). We have ongoing concerns about the impacts of climate change on agriculture.

But opportunities to save money on energy use, improve our operational efficiency and our bottom line, and reduce greenhouse gas emissions are also there.

In this issue, we focus on some of the people who are using the energy challenge as a catalyst for positive action. We talk about the initial steps of assessing current energy use. And we also look at the exciting opportunities of integrated options that save money on energy costs while also generating other benefits for the operation. Dr. Les Fuller, the Chair of Environmentally Sustainable Agriculture at the University of Alberta, gives us another view on the link between energy use and sustainability in his new column.

As farmers and food processors, we can complain about energy prices or we can find ways to reduce consumption and produce our own clean energy. It makes environmental sense and economic sense to improve energy management. As we do our part, the Kyoto Agreement commitments, whether nationally or internationally, become less of a cost and more of an opportunity. Doing things right on the consumption side and production side will get us well past any commitments imposed by outside agencies.

## WHAT'S INSIDE



Issue No.15, Spring 2003

# Energy in Agriculture

## Challenges & Opportunities

When a late April snowstorm dumped two and a half feet of snow on Bruce Beattie's farm near Sundre, the power was off for four days. Along with his energy bills, it was a reminder of the key role of energy in his dairy operation – and of the challenges and opportunities in energy management for the agriculture industry.

Energy use is a major input cost for many agricultural operations, including Beattie's. Energy use is also a major source of greenhouse gas emissions generated by human activity, which scientists believe are contributing to global climate change. Beattie is a board member of Climate Change Central, and this year's two-week spell of heavy spring snowfalls reminded him of one of the predicted impacts of climate change – a greater frequency of severe and unusual weather events.

He says, "If the people who say there is climate change are right, then everything we can do to reduce it is a good thing. And even if they're wrong, all the things we are doing to reduce greenhouse gas emissions still have strong economic and environmental benefits. But if they are right and we don't reduce emissions, then we're in big trouble. So why not err on the side of caution?"

> "Adaptation to changing conditions is an integral part of agriculture's future in Alberta."

From Beattie's perspective, agriculture's horizon is clouded by the potential for negative impacts from climate change and for increasing economic, environmental and social pressures to reduce energy use. These challenges are prompting Beattie and other producers to improve energy management. They are making changes that range from simply replacing incandescent light bulbs with compact fluorescent bulbs, to developing integrated options that provide diverse benefits while saving energy. Beattie says, "Adaptation to changing conditions is an integral part of agriculture's future in Alberta."

### First steps for change

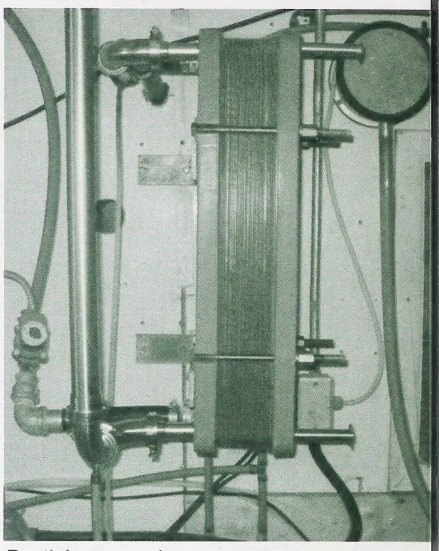
In many cases, producers can start with inexpensive, straightforward changes that will significantly improve farm energy management. "On average, farm energy costs can be reduced by 10 to 15% simply by proper maintenance and minor modifications to operating practices," says Tamara Lewis. Lewis and Katrina Lakenman of Alberta Agriculture, Food and Rural Development (AAFRD) have co-authored an easy-to-use workbook for farmers and ranchers called First Steps to Energy Management: Save Energy and Money.

This AESA Program funded publication helps producers to determine and evaluate their energy use and costs, and provides a variety of energy-saving tips. "By evaluating farm energy use, a producer can figure out some simple, low-cost changes that can save a significant amount of money," explains Lewis.

For copies of First Steps to Energy Management contact the AAFRD Publications Office at 1-800-292-5697.

### Integrated changes

An integrated approach to energy management may provide benefits beyond improved energy efficiency. One small-scale example of this is Beattie's pre-cooler on his bulk milk cooling system. He explains, "It cools the milk with water before the milk gets to the bulk tank. That reduces the energy requirement for the refrigeration unit. The water going through the pre-cooler is heated and can be used in various ways. In my case, it is piped to the barn and the cows drink it. The cows really like the warm water so they keep right up with [the water consumption needed for milk production]."



Beatie's pre-cooler saves energy costs and provides heated water

Co-generation – the simultaneous production of heat and power from the same energy source – is another integrated option. For example, carbon from organic materials like manure can be captured to produce methane for heat and electricity. Co-generation allows an operation to produce enough energy to meet some or all of its own needs, and in some cases to sell excess energy. And co-generation may also produce other economic and environmental benefits (see Harvesting Manure for Energy and Much More).

Beattie believes demand for such integrated options will grow. "To me, the real push is not only to reduce energy use but also to ensure that we're using all of our resources efficiently – whether it's using manure to improve soil tilth and also reduce our need for commercial fertilizer, or using a pre-cooler to save energy while also providing heated stockwater."

He adds, "If we are looking at an energy-constrained future with highly competitive markets, then the more quickly and effectively we adapt to these new technologies, the brighter our future looks."

# Harvesting Manure for Energy, Nutrients & More

"We see so many benefits – economic, social and environmental – to converting manure into green energy and bio-based fertilizers that we just can't overlook this opportunity," says Mike Kotelko, vice president of Highland Feeders near Vegreville. "We are working hard to develop the Integrated Manure Utilization System (IMUS) technology, and we're excited about discovering its full potential."

Kotelko is working with a team of scientists and engineers headed by Dr. Xiaomei Li of the Alberta Research Council to turn feedlot manure into biogas for electricity and heat, bio-based fertilizers, fibre for industrial use, and water for irrigation. Both Kotelko and Li believe the process has the potential to generate revenue for producers while reducing greenhouse gas emissions and odours, and eliminating pathogens (disease-causing organisms) in the manure.

This project's anaerobic digester technology (see diagram), already in use on European farms, is sometimes considered impractical for North American farms. Kotelko sees two key barriers to the growth of this technology: producers believe that it is too costly and that current manure management practices are sustainable in the long term. Fuelled by a willingness to think outside the box, Li and Kotelko are crossing these barriers to find a way to realize the full value of manure.

The project's first phase, a feasibility study, began in 2001. The results showed that, if the process works as expected, it could be "viable both environmentally and economically," says Li. "Originally, the idea was targeted at addressing environmental concerns, but the more we looked at it, the more we thought that there is potential to make money."

In Phase 2, the team created a small-scale pilot plant that uses solid feedlot manure instead of liquid manure, which is more commonly used in digesters. The purpose of this phase was to determine the exact requirements for the digester, nutrient recovery and fertilizer production processes, and the characteristics of their outputs.

> "... the more we looked at it, the more we thought that there is potential to make money."

The digester uses anaerobic bacteria (bacteria that don't need oxygen) to convert the carbon in the manure to biogas, mostly methane and carbon dioxide. This biological process requires frequent, precise adjustments. To make these adjustments, the team has created a fully automated system that is straightforward to operate.

Phase 3 is a three-year demonstration of a full-scale IMUS system at Highland Feeders. The plant is scheduled to be constructed this summer and to start producing biogas in the fall. This phase will test and fine tune the system and assess its economic viability. Kotelko is leading this phase.

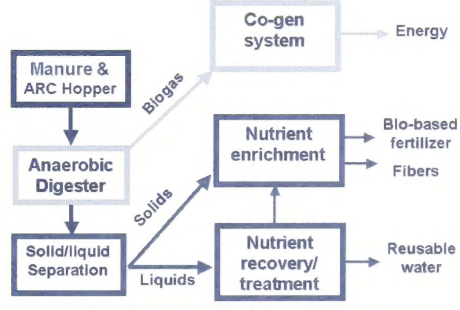
"We think we can demonstrate the economics of the process relative to the size of the cattle industry," he says. "The pilot plant is designed to handle manure from 7000 to 8000 head of cattle which is an average sized feedlot in western Canada." He adds, "Any time you're developing a new process, the costs can be high. But as you develop the process, you uncover opportunities to reduce the capital and operating costs." Li notes, "We believe we have to capitalize on both the biogas and bio-based fertilizer to make the system economical."

Kotelko says, "In addition to all of our feedlot's power needs, we expect the biogas plant will provide a significant additional amount of electricity, reducing our power costs while generating revenue by sales through the Power Pool. We also feel that the electricity produced will be recognized as green energy and that extra value will be associated with that."

The fertilizer by-product also offers several advantages. "Typically we can't haul raw manure more than 10 or 12 miles and realize a net economic benefit," explains Kotelko. "Nutrients in the fertilizer are more concentrated, odour is eliminated, and the pathogens are killed. The result is a much more desirable and marketable product." The IMUS process also captures nutrients and carbon that would otherwise be lost as ammonia, methane and carbon dioxide emissions during composting or spreading.

"I think the system will provide a significant opportunity for the livestock industry to increase profitability and long-term sustainability," says Kotelko. "By treating manure as a resource we can capture its full value as well as reduce soil, water and air pollution. It's a win-win situation for agriculture and the environment."

## An Integrated Manure Utilization System



# Opting for Saving Energy in Processing

photo credit AAFRD

Rising energy costs and long-term concerns about greenhouse gas emissions are causing Alberta processors to take a closer look at their energy use. However, options for enhancing energy management in processing facilities can range from simple to complex. Now some processors are getting assistance in deciding which options would be best for their own facility.

## "Lean" energy assessments

An initial step for improving energy management has recently been taken by 10 Alberta processing companies. They participated in the pilot version of the Alberta Food Processors Association's Lean Processing program, launched earlier this year. Under the program, a team of experts toured processing facilities and provided advice on improving plant efficiencies, including energy use.

"The Lean Processing team included people who were specialists on the financial aspect, the business aspect, the processing aspect, and so on," says Ken Charters of Trimark Engineering, the largest engineering firm in Western Canada to specialize in food and beverage processing. Charters was the team member providing energy management advice.

"Agricultural processing facilities use a lot of natural gas for heating and a lot of electricity for motors, refrigeration and lighting. Wherever a lot of energy is being used at a facility, there are usually many opportunities to use that energy more efficiently and save money," says Charters. The 10 companies in the pilot included a bakery, potato processor, hay processor, two meat packers, and manufacturers of pet food, sandwiches, corn chips, sugar and honey.

Even though the program's half-day visits to each plant didn't allow for detailed measurements and analysis, all of the companies were given ideas for saving energy that they could implement immediately. Some of the recommendations common to many of the facilities were:

- Shutting off equipment and lighting when not needed.
- Preventing simultaneous heating and cooling of the same space, by segregating areas that need to be heated from areas that need to be cooled.
- Replacing equipment and lighting with more efficient models, as they need replacing.
- Testing air compressors for leaks and repairing leaks.
- Conducting motor loading surveys to make sure motors are not oversized.
- Considering the use of variable frequency drive (VFD) technology in applications where motor speed can be varied.
- Insulating all steam and hot water piping.

Charters says, "Because energy is such a significant cost in these facilities, we recommended that all 10 companies develop an energy management program and consider having an energy audit. In an energy audit, each energy-using piece of equipment in the facility is assessed as to its efficiency, operating costs and potential for increasing efficiency and reducing costs." An energy audit also allows a cost-benefit evaluation of potential capital projects such as heat recovery (capturing excess heat and using it elsewhere in the facility) and co-generation (simultaneous generation of heat and power).

The results of the pilot are now being evaluated. The pilot was funded by Alberta Agriculture, Food and Rural Development (AAFRD), with contributions from Alberta Economic Development, the National Research Council, Trimark Engineering and Energy 2000 Consulting.

## Support for energy audits and more

Natural Resources Canada's Industrial Energy Audit Incentive program can help a company offset the cost of hiring a consultant to conduct an energy audit of the company's facility. The program will pay 50% of the cost of the energy audit up to $5000.

More information on this program is available from Natural Resources Canada (http://oee.nrcan.gc.ca/cipec/ieep/iei/products/services.cfm) and the Ontario Centre for Environmental Technology Advancement (OCETA) (http://www.oceta.on.ca/programs/nrcan.htm). (Natural Resources Canada has contracted OCETA to assist in the marketing and delivery of the program.)

> "...there are usually many opportunities to use that energy more efficiently and save money."

Further assistance for energy management projects may be available through AAFRD's Agri-Processing Incentive Program. "For example, if a company wants to do a more in-depth engineering study as a result of the energy audit, then we could cost-share some of that cost through our program," explains Peggy Marce of AAFRD.

This program is designed to promote value-added growth, diversification and competitiveness. It provides cost-shared funding for processors to pay for services or materials provided by a third party. Assistance is available for a wide range of projects, including energy-related projects. For more information, contact the Agri-Processing Branch at 780-427-7325.

COUNCIL PROFILES

## Bob Barss

Communication is a strong theme in Bob Barss' busy life. As a Reeve and a representative on diverse committees, he emphasizes sharing viewpoints and information between different groups.

Barss entered municipal politics because "I felt there needed to be more communication between the councillors and ratepayers, about what was going on and why things were being done." He was first elected to the council of the Municipal District of Wainwright in 1995, and has been Reeve since 1997.

Courtesy of Bob Barss

In 2001, Barss was elected as a director of the Alberta Association of Municipal Districts and Counties (AAMD&C). He says AAMD&C provides a communication link between municipalities and the Alberta and federal governments. "We are the go-between. We meet with the ministers and MLAs on a very regular basis, and bring forward concerns and issues from the municipalities, based on the resolutions passed at the AAMD&C spring and fall conventions."

"...so much is hinging on the way we farm."

Barss represents AAMD&C on AESA Council and 12 other committees that cover a large range of interests from fire training to transportation for disabled people. His roles on these committees include information sharing – bringing input from the municipalities and taking information back to them.

"The municipalities come to AAMD&C for a lot of information, so it's important that we have representation on these boards, especially AESA Council because so much is hinging on the way we farm. Environmentally sustainable agriculture will play a big part in how we farm in the future, from carbon credits to environmental farm plans."

Environmental stewardship is an essential element on the Barss farm. He and his wife grow crops and have a cow-calf operation on their 1200-acre farm near Wainwright. About half of their cropland is under zero tillage and the rest is under minimum tillage. They use a sprayer system that allows them "to reduce chemical application rates to about 50 to 60% of the recommended rates. That's financially rewarding and a lot safer for the environment." And their environmental farm plan is near completion.

Barss says, "The farmers of the next generation are probably going to have some tough times, the same as we did. If we can make things environmentally safe and sustainable that will give them a head's up and hopefully they can be guided down the right path." So you might say, environmentally sound practices not only help maintain and enhance a healthy landscape today, they also provide a way to share the stewardship perspective with the next generation.

## Kim Schmitt

"What I like best about my job is the opportunity to work and interact with many people from different sectors, particularly at this time when so many of the people within industry and government are working toward mutual outcomes in environmental sustainability issues," says Kim Schmitt.

Schmitt is an Industry and Government Liaison for Ducks Unlimited Canada (DUC). He works with such industries as agriculture, oil and gas, and forestry, and with municipal, provincial and federal governments, to achieve common objectives.

Schmitt says, "The mandate of Ducks Unlimited is about conserving wetlands and associated habitats for waterfowl, wildlife and people." DUC works with government, industry and landowners to maintain and restore wetlands, riparian areas and other water bodies, maintain healthy native grasslands and woodlands, and encourage perennial and fall-seeded crops on agricultural lands.

"...we're all looking for very similar outcomes."

DUC's habitat conservation activities not only benefit wildlife, they also provide abundant benefits for people – like clean water, flood protection and productive soils. Such important shared benefits make collaboration with others a natural fit for this private, non-profit agency.

In his more than 20 years at DUC, Schmitt has worked in various capacities, including field biologist, agreement negotiator, and manager. He currently represents DUC on several Alberta boards and committees, including the Environmental Farm Plan board, Agriculture and Food Council, and AESA Council. A common thread among these agencies is a focus on environmental stewardship on agricultural lands.

Schmitt says, "Ducks Unlimited has a lot of mutual interests with the agriculture industry. We have a different history and sometimes different stakeholders, but we're all looking for very similar outcomes." For example, he notes, "many of the beneficial management practices involved in the [Environmental Farm Plan] program are practices that Ducks Unlimited has researched. We know these practices have significant environmental benefit."

DUC's joint activities with landowners include consideration of the economics of stewardship. Schmitt is playing a role in advancing this aspect of stewardship as a member of AESA Council's Conservation Economics Task Team. "The team has done some really exciting work. We just finished an interesting project on environmental goods and services." (See Green Matters, Winter 2003, for information on this subject.) The team partnered with the Agriculture and Food Council and a multi-disciplinary group of experts for strategic planning on this topic.

Roth & Ramberg Photography

"DUC sees addressing the economic barriers to stewardship as necessary to make any large gains in environmental sustainability," says Schmitt. "We deal with the private landowner, the private producer, and that includes economic realities."

# The Science of Sustainability

## A Fuller Perspective

University of Alberta

**Dr. Les Fuller, P.Ag.**

Chair, Environmentally Sustainable Agriculture

University of Alberta

## Agriculture and the Energy Fix

Many times I am asked the question, "Is our current agricultural production system sustainable?" I usually begin my answer by asking a question, "What do you mean by the word 'sustainable'?" The answers to my question usually involve variation around the theme of maintaining intergenerational productivity without degrading the ability of the resource base to support that productivity. Thus, productivity, in many people's minds, is closely linked to sustainability. So if we hope to answer the sustainability question with a "Yes", then we must not only work on conserving the resource base, but also turn our attention sto productivity. Productivity goes hand-in-hand with energy.

Modern agriculture, like most aspects of modern society, has developed within the context of relatively cheap and accessible energy derived largely from non-renewable fossil fuels. This energy has been used to increase crop and livestock production and to replace labour. The manufacture, transportation and use of agricultural inputs, such as fertilizers, pesticides and machinery, are responsible for much of the energy use in the food production system. Agriculture's productivity increases are largely supported by an "energy fix".

Our agricultural system has generally invested in energy instead of ecological knowledge, even though agriculture is biologically based. For example, we have learned to reach for the energy fix in nitrogen management. The Haber-Bosch process is an energy-intensive chemical reaction that converts dinitrogen gas in the atmosphere into ammonia, the building block for nitrogen fertilizers. Natural gas fuels this process. The effect of gas prices on fertilizer prices and the resulting impact on fertilizer use show that as long as nitrogen fertilizer is cheap and accessible, most producers will use it to maximize yields. When fertilizer prices rise, producers look for alternatives like growing legumes. The ability of legumes, with the help of rhizobia bacteria, to pull nitrogen out of the air and convert it into a form that plants can use was around long before the Haber-Bosch process of burning natural gas to do essentially the same thing.

Some cropping systems are characterized by vast areas of a single crop. These are a pest's "heaven on earth". Applying an energy-intensive pest control product treats the symptom, but does not address the root cause of the pest problem. Once again we rely on the energy fix because it is effective in the short-term and much simpler than attempting to understand the complex functioning of diversity and predator-prey relationships that control pests in nature.

So, back to the question, "Will agriculture be able to sustain today's level of productivity?" The answer is clearly linked to the question, "Will energy be accessible and affordable?" To be sustainable, agriculture will have to place more focus on energy conservation and efficiency and on finding affordable, renewable energy sources. In addition, we will need to reduce our dependency on energy-intensive inputs and increase our knowledge of ecological processes. Agriculture's sustainability will be determined to a great extent by our answer to the energy question.

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*Green Matters* is the newsletter of the Alberta Environmentally Sustainable Agriculture (AESA) Council. AESA Council consists of 29 representatives from Alberta's agriculture and food processing industry, environmental organizations and government. Its mandate is to: identify and evaluate environmental issues facing Alberta's agriculture and food processing industry; encourage the industry to proactively address these issues; advise the Alberta Minister of Agriculture, Food and Rural Development on these issues; and direct the AESA Program.

The purpose of Green Matters is to provide a forum for discussion of environmental issues in Alberta's agriculture and food processing industry.

To subscribe to Green Matters, call 780-422-4385.

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